DOCUMENT RESUME

ED 167 131 IR 006 888

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TITLE College Library Instruction/College Instruction: A Review of the Literature.
INSTITUTION Bloomsburg State Coll., Pa.
PUB DATE Oct 78
NOTE 27p.

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS Academic Achievement; Behavioral Objectives; Evaluation; Higher Education; *Library Instruction; *Literature Reviews; Needs Assessment; Programs; Research; *Undergraduate Students

ABSTRACT

This review of 64 recent works concerning research in library instruction at the college level attempts to place this research in the larger context of learning outcomes and instructional approaches for undergraduates teaching in general. A live lecturer presenting subject overviews to large audiences, small student-centered discussion groups, and varied instructional media will enhance achievement levels of students being taught to use college libraries. Behavioral objectives might be used to improve achievement in library learning although it is less certain how they might improve instruction and the evaluation of learning. There is slight evidence to support inferences regarding cognitive knowledge retention, and none regarding the transfer of knowledge from use of one library tool to another. Sufficient information about the transfer of theoretical textbook knowledge to practical in-library use is also lacking. In-house media have been reported efficient only on a long term basis; therefore, library instruction programs, especially experimental ones, could benefit from use of commercially produced media for learning standard tools. (Author/MER)

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BLOOMSBURG STATE COLLEGE
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# COLLEGE LIBRARY INSTRUCTION/COLLEGE INSTRUCTION

## A REVIEW OF THE LITERATURE

by

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October, 1978

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COLLEGE LIBRARY INSTRUCTION/COLLEGE INSTRUCTION

A REVIEW OF THE RESEARCH LITERATURE

## PREFACE

The brevity (64 entries) of the most recent review of library instruction research (Young, 1974) is indicative of the scarcity of such research. Not all of these studies deal with academic instruction, and the research on library-use patterns does not even deal directly with instruction per se but, as Young points out, should be considered when designing a program of instruction.

This review attempts to place what has been done in library instruction research in the larger context of the learning outcomes and instructional approaches for undergraduate teaching in general. Since college instruction is a broad field which has seen many media and techniques, limitations must be set. Only approaches which have been subject to numerous studies are considered.

LEARNING OUTCOMES IN COLLEGE LIBRARY USER EDUCATION

We ought to know enough of outcomes for library instruction that we can place a sufficient amount of it in the college curriculum at the most advantageous time/s. Further, we ought to know whether it is better to offer library instruction as a separate course or to make it auxiliary to another. Achievement of library knowledge ought to be measured with sufficient confidence as to enable researchers to assess instructional methods with confidence.

Margaret Knox Goggin (1974, p. 105-106), Dean of the University of Denver's Library School, finds that:

> Nowhere in the literature or in the field does there appear to be disagreement concerning the levels of instruction required if the university's clientele is to be efficient in accessing the library's storehouse of knowledge. First, there is the orientation to the physical library, its environs, and how to use its services. Coupled with this is a modicum of library instruction needed by the beginning freshman who, in most universities, needs to cope with limited assignments involving the use of the library. Second, at the time when students select their major and start taking courses requiring the research and the writing of term papers, there is need for an instructional period or series of sessions to acquaint them with the general body of literature in their subject field and the search strategies that might be employed to locate information. At the graduate level the need is for more sophisticated bibliographical guidance and instruction directed to the specialized students.

Goggin also mentions that separate courses in library instruction have been offered to either lower classmen or upper classmen by different schools and that term paper clinics and point-of-use instruction are based upon the assumption that the best instruction is given to students when each recognizes his or her need.

A sequential instructional program integrated with the general education courses at Harding College is described but not evaluated in two articles by Alston (1953, 1960). One of the advantages mentioned by Alston (1953) for integrated instruction is the opportunity for faculty interest to influence

students. This point is also made by Beardsley (1974) who claims that faculty are the greatest motivating force in library instruction programs and that their attitudes about library usage are reflected in those of their students.

Beardsley believes that first-year students should be introduced to the library and instructed later when course work presents library problems since students will be self-motivated to seek or to listen to assistance only when problems arise in connection with their assignments. In agreement with Beardsley, Fjällbrant (1976, p. 253) states that, "It is of the greatest importance to provide instruction at a point when the student experiences motivation for learning about the material to be taught."

Need for Library Instruction.

Although some students realize their need for library instruction, others do not, much as they might not fully appreciate the learning gained from any course until they have taken it. The need for library instruction is also not always recognized by college administrators and faculty who, im some cases, may not have used a library extensively since they obtained their last degree.

Young (1974) reports on the need as seen by the academic community. Based on five opinion surveys of the need for library instruction, a need is recognized by almost all librarians queried. Support for instruction drops for both faculty and students to the degree that in some instances it was less than a majority. Young infers from these studies that students' interest in library usage reflects their teachers' assessment of the library's contribution to educational attainment.

When student improvement in library usage has been demonstrated through library instruction, Lubans (Objectives . . ., 1974) believes that college administrators and faculty may be more apt to actively support such instruction.

Many articles have been written about the need for library instruction and how such instruction could be or is being offered. Krier (1976) includes 362 entries in her checklist of the literature for college and university library instruction between 1931-1975. Her list indicates an interest in the subject which has increased with time; this continues to be the case. A minority of these entries, however, deal with the empirical evaluation of instruction.

Library Knowledge and Academic Achievement.

Several studies reviewed by Young (1974) have attempted to correlate library use or library knowledge with academic aptitude or academic achievement. Thompson and Nicholson (1941) reported only a slight relationship between circulation and intelligence scores, but Knapp (1959) found statistically significant associations between aptitude test scores and course-related borrowing. Snider (1965) reported a correlation of .60 between Southeast Missouri State College freshmen library ability (LAR) and grade point average (GPA). He describes the LAR/GPA relationship as positive, consistent and relatively strong. In a more recent study, Breivik (1974) studied the effects over a period of two semesters of library instruction in the academic success of disadvantaged college freshmen. The groups having weekly higher level instruction achieved somewhat higher course scores than the groups receiving minimal instruction, which in turn achieved considerably more than those groups having no instruction.

Young (1974) sees a "priority need" for longitudinal (long-term) studies that assess the impact of library instruction programs on subsequent academic achievement.

Measurement of Library Knowledge.

Types, methodology and the need for evaluation of library knowledge are discussed by Fjällbrant (1977) and for evaluation generally by Gronlund (1976). Measurement of library knowledge being described as either: 1) Diagnostic or summative, 2) individual assessment or instruction evaluation, 3) theoretical or applied.

The diagnostic test is designed to indicate what a student does not know about libraries and would normally be administered before instruction. A diagnostic test might be used to tell what areas of library instruction need to be stressed for an individual or might exempt a high-scoring individual from instruction altogether. A summative test comes after the instruction and is used for determining the extent instructional objectives have been achieved and for assigning course grades.

In an analysis of sixteen library-use tests, Bloomfield (1974) notes that half were constructed during the 1930's, the rest during the 1940's to 1960's. Bloomfield cites Phipps (1969) as finding that the most used test, A Library Orientation Test for College Freshmen (the "Feagley test"), is devised for diagnostic or pretesting. Reviews in the fifth and sixth

mental measurement yearbooks (Buros, 1959, 1965; test 693) confirms that, at the college level, the test should only be used for diagnostic purposes. Bloomfield himself mentions several additional areas of weakness in the Feagley test which preclude its use as either a summative assessment of a comprehensive library instruction program or of an individual's achievement in such a program. Young (1974) claims that no library test published has undergone the rigorous evaluation required for complete standardization.

Stewart (1976) notes that the Feagley test covered neither the depth nor the breadth of information taught in a Ball State library instruction course and recommends that a standardized library skills test be developed.

Young points out two potential weaknesses of any standardized test of library knowledge: 1) any test of knowledge of information to be found in libraries nationwide is bound to be a compromise, and 2) a written exam may be too artificial a device to ascertain a student's ability in an actual application of library tools. The second point has been considered by Wiggins and Low (1972) who prepared two summative tests -- one which used a booklet simulating basic periodical indexes, and another test using the indexes themselves. Since there was no correlation between the two tests, they conclude that application of the actual indexes was more effective.

Course evaluation might be undertaken with a homemade battery of tests which sample areas of course content. Lubans (Evaluating. . . , 1974) cites Temple Buell College's use of the Feagley test together with the Library Proficiency Test to measure the effect of a two week program. He also describes the use of questionaire surveys for the evaluation of library instruction. Such evaluation, while helpful, is limited to an opinion of program effectiveness.

In their review of the library instruction movement, Farber and Kirk (1976, p. 59) emphasize the need for proper evaluation:

> A final issue, and one of crucial importance to the entire movement, is that of evaluation. Everyone who is sincerely interested in bibliographic instruction realize that the lack of systematic evaluation is one of the movements biggest handicaps. There is some hope that setting behavioral objectives will help form a basis for an evaluative methodology.

Behavioral Objectives.

The Association of College and Research Libraries Bibliographic Task Force (ACRL, 1975) has developed a model statement of library instruction objectives for undergraduates. The general objective of efficient and effective use of library resources and personnel in completing an undergraduate program is prefaced by an acknowledgement that such instruction should also prepare students for life-long library usage. The model statement consists of terminal objectives covering a wide range of student usage which are accompanied by several enabling objectives. Libraries adapting the enabling objectives to their particular situation are encouraged by the task force to make them specific and measureable.

Using behavioral objectives as a base for developing both instruction and test questions, Wiggins & Low (1972) created a periodical index program required in the sophomore English curriculum. Results greatly favoring the experimental treatment over no treatment are reported below in the section dealing with programmed instruction.

There is little doubt that one of the major difficulties in evaluating the effectiveness of library instruction is the lack of a comprehensive standardized instrument of measurement. One of the difficulties in using such a test is demonstrating that the theoretical knowledge tested is transferable to use of actual tools in the library. Little research has been done to determine levels of retention and transfer of library instruction which would make it possible to determine more accurately how much should be offered and when.

Relying upon the advice of practicioners and evaluators of library instruction, it would appear that instruction integrated with other courses would be more likely to benefit from higher student motivation than would a separate library instruction course.

## LEARNING OUTCOMES IN HIGHER EDUCATION

The most studied learning outcomes are achievement and attitude, which are discussed below as means of evaluating instructional approaches. Almost all research in library instruction, as evidenced by the previous section, has considered only these outcomes. The measurement of transfer and retention of learning, however, may answer questions of importance to library instruction: 1) Is the knowledge of basic library tools transferable to usage of more complex tools? 2) Is the knowledge of simulated library searches through instruction transferable to usage of the actual tools? 3) How much learning of library usage achieved at the freshman level of college, where it would anticipate four plus years of potential college library use, is retained at the junior/senior level where most of the in-depth library usage is apt to occur? 4) How much knowledge of college library usage is retained after graduation and transferable to use of univesity, special, or public libraries to pursue (not necessarily in respective order) educational, vocational, and recreational interests?

Transfer.

Transfer of learning is the effect of previous learning or subsequent learning and consists of both specific effects (content-related) and nonspecific effects (principle or method-related). Because of the amount of learning attained by the time a student has reached college, it may be that results of the more plentiful k - 12 transfer studies cannot be generalized higher.

One of the few studies of cognitive transfer in higher education was done by Voss (1974) who studied the nonspecific learning transfer effects of college students by testing four trials of either multiple choice or completion questions dealing with the learning of three unrelated prose passages. Although a small degree of transfer was expected, an analysis of variance revealed that differences among the three sets of responses were not significant. It is very likely, as Voss speculates, that the results may have been contaminated by previous content knowledge. Analysis between the type of test questions determined that multiple choice questions may impede progress in improving learning over successive trials, which Voss attributes to the introduction of erroneous responses by multiple choice.

Gronlund (1976) theorizes that transfer of learning is most likely to occur where: 1) learning outcomes have wide applicability, 2) pupils expect transfer to happen, and 3) pupils recognize the similarity between new situations and familiar situations in which the learning has been applicable.

Retention.

Gronlund (1976) states that the sparse evidence demonstrating the relative permance of various learning outcomes suggests that retention increases as the complexity of the learning outcome increases.

The difficulties of assessing retention are reviewed by Wodtke (1967) who believes that the value of retention research has been understressed and that the results of earlier simplistic research in this field may be invalid. Retention research designs must be sophisticated enough to measure retention effects accurately and uniformly without being confounded by learning effects.

In a recent and fairly sophisticated experimental study of Bell Lab technical employees taking college-type courses, Landauer and Ainslie (1975) measured the retention efffect of six-week and six-month interim testing. Gains from a one-year test for the six-month test group was significantly greater than those of either the six-week group or the control group. From this, the authors conclude that learning can apparently be retained over long periods by using properly spaced review activities, such as tests. Landauer and Ainslie do not specify the type of test used; if it included erroneous responses it would seem that the results of this study might counter Voss's argument about multiple choice contaminating transfer.

Behavioral Objectives.

Duchastel and Merrill (1973) see three main instructional functions of behavioral objectives: a) direction for teaching and curriculum development; b) guidance in evaluation; and c) facilitation of learning. Concentrating on this last function, this review finds five studies showing a significant effect of behavioral objectives on learning, but another five, however, show no effect. While the effects of behavioral objectives on the learning function are inconclusive, Duchastel and Merrill suggest that behavioral objectives can be used to provide aid in discriminating between relevant and incidental or illustrative content and to provide organization to the subject matter being learned.

Anderson, DeMelo, Szabo, and Toth (1975) investigated the effects of giving behavioral objectives to students enrolled in a university elementary science methods course. This study found that the groups given the objectives scored significantly higher at both high and low cognitive levels than did groups given a placebo. The authors conclude that the use of behaviorally-stated learning outcomes facilitates immediate learning.

Although the constructs of transfer and retention are of considerable value to library instruction design, they have been measured with only limited success for cognitive learning in higher education. This is largely due to the design control necessary to isolate transfer and retention from other learning effects. Until further research leads us to more scientific conconclusions, we may do well to follow Gronlund's common-sense approach to increasing transfer and retention of learning: 1) focus attention on those learning outcomes that are most permanent [once we determine which those are] and most widely applicable, and 2) provide the student with practice [or tests as suggested by Landaner and Ainslie] in applying previously learned skills and ideas in new situations.

The use of behavioral objectives as a learning device appears to be effective. Their efficacy as a device for directing teaching and facilitating learning evaluation is not known but such utilization bears consideration.

## APPROACHES TO COLLEGE LIBRARY INSTRUCTION

The effectiveness of several instructional approaches have been demonstrated but, as we have seen above, mostly for the physical sciences. We cannot automatically assume that similiar results will be achieved for library instruction courses without further research. These studies should be of such design that no hypotheses alternate to the author's can be logically supported. They should be of such a number that we do not find ourselves comparing the effectiveness of, say, a televised unit against a lecture unit rather than the instructional methods per se.

Lecture/Discussion.

The lecture is one of several methods of library instruction discussed by Fjällbrant (1976), who recommends that it be limited to: 1) use as a stimulus, 2) present an overall view, and 3) convey enthusiasm about the subject. She reports that of the fourteen hours included in the introductory information retrieval course at Chalmers University in Sweden, only two hours are given by lecture.

A lecture/discussion group meeting in the library science library of Ball State University and discussing research problems from other courses was found by Stewart (1976) to have significantly higher scores than any of three control groups. One control had a one-hour library tour plus at least six hours of search strategy taught by a professor of English; the other controls received no treatment. However, the hours of instruction given the experimental group was not reported. The study also revealed that previous library use and work experience had more effect on library knowledge than did subject majors, class level, or previous library instruction. The lowest pretest scores were obtained from the sophomore-level group with the most S's having previously had the now discontinued "one-shot" lecture tour.

Television.

Melum's survey (1971) finds five universities currently using televised instruction or orientation, four colleges or universities planning its use, and six colleges and universities having discontinued all or part of their televised programs. It is the only category reporting discontinued use, which may be significant since Melum mentions that many

colleges lack the facilities and talent to produce and reproduce effective programs.

The use of a videotape thirty-nine minute orientation/instruction session for an introductory education course at the University of Illinois is discussed by Holley and Oram (1962). Non-experimental results of a ten-question quiz following the videotape were low, but no lower than scores from an earlier session taught by a lecture tour. The authors conclude that the scores provided "at best a rough estimate," suggesting that the same amount of information provided in a lecture/tour can be had using videotape with less instructional effort required.

Television plus an introductory lecture was found to achieve results similiar to those of a traditional (lecture-based) method by Moffett (1966) at the University of Florida. This study concludes that the televised method is both effective and economical in accomodating large numbers of students in the undergraduate "Using Books and Libraries" course.

Slide/Tape.

Melum reports that slide/tape presentations were used for group orientation or instruction at twenty-five colleges - half again as many as any other non-print medium. According to Fjällbrant (1976), this format is advantageous for library instruction for the following reasons: 1) flexibility, 2) availability, 3) ease of presentation, 4) variable speed of presentation, 5) low production cost, and 6) ease of updating material. Fjällbrant reports that enough interest in slide/tape library instruction was present in Britain for the Standing Conference on National and University Libraries (SCONUL) to set up their Working Group on Tape/slide Guides to Library Services in 1970. Evaluation of the SCONUL slide/tapes at the Swedish College of Librarianship showed gains in learning and also a positive attitude toward slide/tape by 80 percent of the students.

Slide/tape instruction was found to be more effective than lecture, audiotape, or televised instruction (Kuo, 1973) for science division students at Portland State University. Using a randomized block design and a validated ninety-item test, this study found forty-six minutes of slide/tape general science instruction to be significantly higher at the .01 level than lecture for a comparable time, the tape alone, or an untreated control group. The slide/tape group (Group S) acheived significantly higher results than that instructed by television (Group AT) at the .05 level. Students

reported that the televised images were inferior to those directly viewed from slides.

Computer-assisted Instruction.

A brief overview of CAI and its history in library instruction, primarily at the University of Illinois, the University of Denver, and Ohio State University, is provided by Clark (1974). Clark sees the library as a natural setting for CAI since students view the library as a center for learning. Since students are using computer terminals for the solution of problems presented in a number of courses, they may need less motivation to use CAI for library instruction than for other methods. Much of the high initial cost of constructing a CAI program may be avoided by adopting an already proven program written for another library. Clark concludes that CAI should be used as just one among many technological means for supplementing person-to-person instruction.

From a questionaire survey of several CAI lessons on the use of basic research tools at the University of Denver library, Hansen (1972) finds that 94 percent of the respondents said they learned what they wanted to know, 84 percent found CAI more valuable than other library use instruction they had had, and 85 percent expected to use CAI again for other lessons.

The only experimental research in CAI for library instruction was done by Axeen (1967) in her comparison of CAI using the PLATO system with the lecture method in teaching a library usage course at the University of Illinois. She concludes that:

> 1. Students under both treatments made significant gains in their knowledge of library use. 2. The experimental and control groups did not differ significantly in the amount of knowledge gained as a result of their respective treatments. 3. It was seen that in class the experimental group covered the same amount of material in less time than the control groups. 4. Much more time was required for the initial preparation of PLATO lessons than conventional lectures. 5. Subsequent preparations for PLATO lessons required much less time than subsequent conventional lecture preparations. 6. PLATO instruction required less teaching assistance than conventional lectures. 7. Instructors' time during administration of lectures far exceeded the amount needed for the administration of the PLATO method.

Programmed Materials.

Only four academic libraries reported using programmed materials in 1971 (Melum). Since then they have been reported to have been used in several programs, usually in the format of a study guide for students to complete in the college library.

Kirk (1971) compared the use of a guided exercise with a two-hour lecture-demonstration in teaching reference tools and the card catalog to Earlham College students taking an introductory biology course. Results from three measures: 1) Librarian-evaluated student bibliographies, 2) an objective test, and 3) a controlled word association exam, showed no significant differences with one exception - one set of bibliography scores favored the guided exercise, but only at the .20 level of confidence. A survey of student opinion of their instruction yielded similar results. Kirk concludes that since neither method is superior in terms of achievement, other criteria must determine selection. Although the guided exercise took more student time and presents a problem of overusage of reference tools refered to in this guide, Earlham chose this method over lecture because of long-term savings in teacher time, flexibility of presenting guided instruction, and the self-paced aspect of the exercise. Also of interest to library instruction are Kirk's findings that 1) the instruction group taught by a librarian sought out librarians more often for completion of assignments than did the exercise group, and 2) examination questions originally written by the biology department faculty were not based upon the best library sources and could not all be reasonably answered on the basis of library holdings.

No significant differences between a programmed study guide and instruction by lecture was also found by Duvall (1975) in a study of undergraduates enrolled in a course of library instruction at Brigham Young University. This experiment compared the two methods in teaching the use of general periodical, book, and newspaper indexes. Like Kirk, the Duvall design does not measure a change in learning outcomes for either treatment.

An earlier experiment (Wiggins and Low, 1972) of teaching general indexes to Brigham Young library instruction students with programmed guides used a no-treatment group instead of a lecture group as a control. Test question validity was strengthened by task analysis and the effects of pretesting, maturation, and history were controlled by a Solomon four-group design

(Isaac and Michael, 1971). The findings, 76 percent of the experimental group selected the correct index and correctly traced the entry as opposed to 15 percent of the control group, cannot be considered completely reliable, however, due to the small number (an average of five) in each of the treatment groups. Wiggins and Low also note that the use of actual indexes rather than a simulated booklet produces better results but presents difficulties in overuse of these indexes similar to those mentioned by Kirk.

Multimedia.

A sixth method of instruction studied by Kuo (1973) was the combination of the slide/tape instruction followed by a fifty minute discussion period with a librarian using transparencies. This group (Group AV) achieved significantly higher results than any other group including that using the slide/tape approach. Kuo suggests that the success of this treatment may be the result of the two-way interaction with a librarian. He also notes, however, that the slide/tape treatment was uniformly externally paced for Group S where it was not for Group AV. The greater treatment time for Group AV (twice that of the others) may also have had an effect.

Wassom (1967) compared an experimental multimedia approach which included some lecture with a more traditional lecture-based approach for Oklahoma State University freshmen. Both treatment groups, each receiving sixteen hours of library instruction, showed a significant increase in knowledge related to library skills and retrieval ability when compared to an untreated control group, but no significant difference was seen between the two treatments. The experimental group did retrieve materials more quickly, however, than either of the other two groups.

Taken alone, the research on library instruction teaching approaches is not of sufficient quantity or sophistication to be used reliably in selecting the approach to best meet instructional objectives. Promising avenues for further study include 1) CAI, especially for point-of-use instruction, and 2) the multimedia approach including lecture/discussion and slide/tapes. The use of a librarian as an instructor may, if nothing else, encourage students to refer to librarians for library questions. Librarians have found in-house media instruction efficient only for long-term application, but have not published studies of the efficacy of packaged units, such as a commercially-produced slide/tape program on basic indexes.

RESEARCH ON INSTRUCTIONAL APPROACHES
IN HIGHER EDUCATION

Traditional Approaches.

The question of selection of instructional approaches -- the means by which information is conveyed to the student -- considers the media of communication in relation to the type of learning outcomes desired. For centuries the means of instruction have been either 1) lecture, 2) discussion, or 3) a combination of the two. A review of these traditional methods (plus newer methods and theory) has been done by Gage (1969) who lists the advantages of the lecture method: 1) economy of student/teacher ratio, 2) adaptability to varying audiences, subjects, time, and equipment, and 3) schedule flexibility. Gage refers to one study which found a dynamic lecture superior to a static one and another which indicates that enthusiasm in a lecture produces greater achievement.

The discussion method, as Gage points out, may be less efficient in terms of student/teacher ratio and information covered per class period, but it provides a two way communication and a type of active learning that is not found in other teaching approaches. The use of a live teacher is recommended for hueristic learning whereas expository learning may be better suited to instructional media.

From a review of six studies investigating college class size and traditional teaching methods, McKeachie (1970) deduces that a combination of large lecture and small discussion sections is preferable to any combination of medium size classes. Nine out of seventeen studies clearly favored the lecture method for factual learning while only four of the seventeen favored the discussion method. For higher level learning, however, all of the six studies reported showed the discussion method to be superior.

Investigation of the college students active vs. passive role in classroom learning is also considered by McKeachie in his review. When student-centered discussion groups were compared to instructor-centered groups, factual learning was achieved better by the instructor-centered groups. The student-centered groups, on the other hand, performed better in four out of five cases. In all but one of the twenty-two studies where it was assessed, attitude was more favorable for student-centered discussion groups.

Media.

Many studies have been done comparing the effectiveness of media-based teaching methods. Most of the research reported (Twyford, 1969; Gage, 1969; Trent & Cohen, 1973) indicates that while the effectiveness of instructional media has been demonstrated, it is neither more or less effective than traditional methods in most applications.

After reading the review of research on college teaching by Trent & Cohen (1973) one can infer that much of the disillusionment with instructional media resulted not so much from inherent inadequacies of the media, but from faculty resistance to change, improper use of the medium, and the abandonment of professional expertise and funding once a media program was begun. Six studies done in the late '60's found no significant difference in achievement between media-based programs and conventional teaching methods. Likewise, eighty four of one hundred studies done prior to 1964 reported no significant gains between televised and conventional instruction.

Trent & Cohen report that student attitude does favor televised instruction, however and that a 1969 study found a much smaller dropout rate in the televised instruction group (.02 percent) than in the control group (14 percent) which the investigators suggest may be due to students being less likely to become hopelessly behind in a course if televised lectures are available to them at any time.

A recent comparison of video-aututorial instruction with lecture for teaching college genetics (Fisher, Guenther, Macwhinney, Sorenson, and Stewart, 1977) demonstrated significantly higher achievement for the video-AT group. Despite some desing difficulties caused by each of three groups on a separate campus, the authors conclude that video-AT seems to be a particularly effective method of instruction for introductory courses emphasizing basic terminology, facts, principles, and relatively simple concepts, and in which the subject matter has visual interest. These findings contrast with the negative results reported a decade ago by Carlson (1973). Although it is not based upon research, this article does demonstrate the problems of using an unsophisticated approach to televised instruction.

Slide Tape.

The use of slide-tape instruction to teach a four week unit on physical fitness was compared to the same slides with lecture by Laurie (1976).

Although the control group had slightly higher adjusted means, an analysis of covariance resulted in no significant difference in the two methods. Laurie concludes that since both methods are effective, giving students a choice of slide-tape instruction or traditional lecture would not result in a loss of achievement.

Computer-assisted Instruction.

Two out of three computer-assisted college instruction research studies reviewed by McKeachie showed an improvement in time savings, achievement, and attitude over conventional instruction. A third study showed no advantage for teaching statistics. McKeachie claims that the computer has had little impact in changing college teaching largely because CAI has not taken full advantage of the computer's capability for flexibility in teaching. A later study reviewed by Trent & Cohen and also another done by Meyer & Beaton (1974) report a favorable attitude toward CAI held by college students. Meyer & Beaton compared the efficacy of CAI with lecture and tutorial (discussion) methods for teaching a one-hour physiology lesson. As no significant differences resulted from either the achievement test, a two-week retention test, or a mid-term test, the conclusion reached was that CAI is an acceptable and efficient (not documented by the authors) system that can complement and supplement conventional teaching methods.

Programmed Materials.

Like CAI, programmed materials place the student in an active role requiring correct responses in order to proceed in a series of small steps. These materials, usually programmed texts, have had varying research results reports McKeachie, citing ten studies through 1968. Trent & Cohen report that two additional studies done in 1968 and 1969 found that programmed instruction produced significantly better recognition test results but was less effective for transfer of learning.

Parker and Mertens (1974) investigated the effectiveness of programmed materials for teaching introductory college biology. Using a design which sought to eliminate reactive measures, the authors found that program-taught students outscored the conventionally taught control groups significantly on three of four unit quizzes. A blind evaluation of discussion performance following treatment also found superior results for the program-taught students. Attitude evaluation, however, indicated that the programmed texts were less enjoyable and interesting than the lectures. Parker and Mertens suggest that programmed texts be used as a supplement to, rather than a replacement for the lecture method.

Multimedia.

Educators dissatisfied with using any one method of teaching have devised multimedia approaches such as PSI and A-T. PSI (personalized system of instruction), also referred to as "behavioral instruction," is derived from reinforcement theory, and was pioneered by R. S. Keller and J. G. Sherman. Research on PSI has been most often applied to the social sciences. Robin (1976) characterizes this approach as featuring: 1) individual pace, 2) unit mastery, 3) lectures as sources for motivation rather than content, 4) written teacher/student communication, and 5) proctor-tutors. Out of thirty-nine studies comparing PSI to traditional college instruction, Robin found thirty to result in significantly higher achievement; of these, seven studies also assessed long-term retention and each found the PSI scores to be significantly higher, but the more complex factor of learning transfer has not been adequately investigated. In fourteen out of the sixteen cases where attitude was compared, PSI again was superior. Not all results have favored PSI, however: the student withdrawal rate averaged 40 percent higher for PSI classes in the fourteen studies reporting it and in three out of five studies recording study time, more time was needed for PSI.

A recent investigation of the effectiveness of behavioral vs. traditional college instruction methods by Jernstedt (1976) found that the behavorial group performed significantly better on an essay exam which was most similar to the papers required to demonstrate unit mastery. The traditional group, however, did better on a multiple-choice test, and no significant difference was seen for a short answer test. Students described the behavioral instruction as producing more learning, taking more work, being more flexible, being more accurate in grading and equal in difficulty compared to traditional instruction.

Audio-autotutorial.

Audio-autotutorial (A-T) instruction is similar to behavioral instruction in its use of independent study and use of lecture for motivation, but generally relies more upon instructional media, especially those with an audio component (Fisher, 1976). Developed by Samuel N. Postlethwait to teach introductory biology, A-T instruction research reviewed by Fisher deals soley with the physical sciences. Of twenty-five studies in the late 1960's and early 1970's comparing A-T with traditional college instruction, Fisher singles out ten as being especially rigorous in design. Six of the ten

studies found significant differences in achievement favoring the A-T groups while four found no significant differences. Results of the remaining studies were even more positive for A-T instruction, and all studies reported that A-T was liked at least as well as conventional teaching. Autonomy and self-sufficiency seem to be especially valued by students. Of three students reporting withdrawal rates, only one showed higher rates for A-T students. Another benefit of A-T named by Fisher is long-range economy after the two and one-half to three year "break-even" point has been surpassed.

Instructional media have been shown to be effective for the teaching of introductory college courses which Fisher (1977) characterizes as emphasizing basic terminology, facts, principles, and relatively simple concepts. While facts and terminology can be effectively taught by either lecture or instructional media, principles and concepts are better conveyed by discussion. It would appear that an instructional approach comprising several different teaching methods, such as A-T or PSI, is more effective for this type of course than any one method alone.

## SUMMARY

Based mostly upon the research of teaching methods in higher education and partly upon that of library instruction, it may be inferred that the following devices will enhance levels of achievement for students being taught how to use college libraries: 1) A live (also alive and stimulating) lecturer to present an overview of the subject to a large audience; 2) Use of small student-centered discussion groups to increase higher-level learning and attitude; 3) Instructional media, preferably offering a choice of media for each unit, used for factual learning. If any one system of instruction is used, PSI will be more likely to be effective than will A-T.

Behavioral objectives might be used effectively to improve achievement of library learning. It is less certain how well they might improve the direction of instruction and the evaluation of learning.

Very little is known about retention and transfer in higher education. With slight confidence we could infer that achievement of library knowledge gained as a freshman would be retained until the senior year (or even beyond) if library usage was practiced at regular intervals. There is no evidence to support inferences regarding the transfer of knowledge either from the use of one library tool to another, or from the use of one library to another.

Neither does there exist sufficient information about the transfer of theoretical "textbook" knowledge to practical in-library use to expect a written test to assess both. One can infer however, that if a written test could effectively measure theoretical learning then a written library test could be standardized without compromise if it tested the theoretical knowledge of tools which should be common to any comprehensive library user instruction program, e.g. use of the card catalog and its subject authority list.

Because in-house media have been reported efficient only on a long-term basis, it may be that library instruction programs, especially experimental programs, could benefit from using commercially produced media for learning standard tools.

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